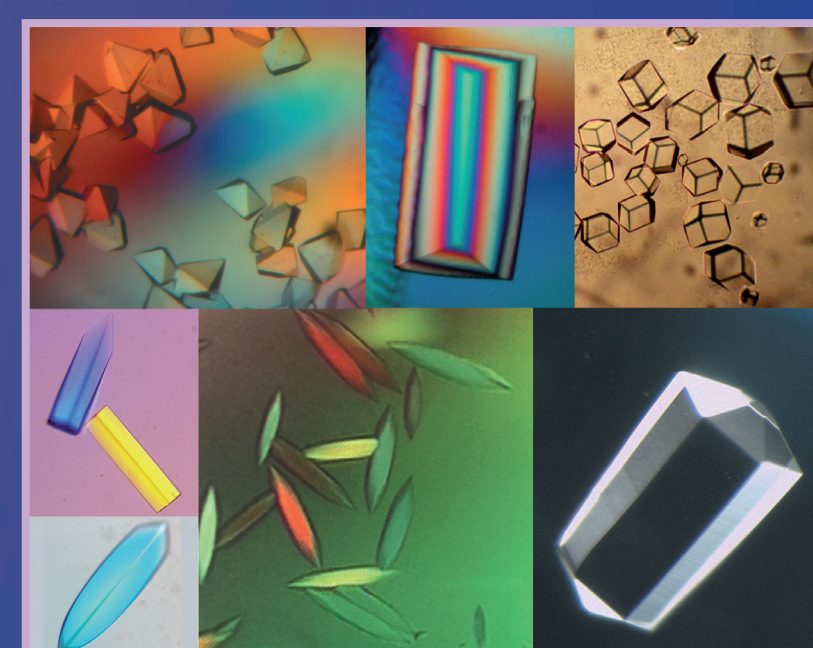


# Cultivating crystals

The specific qualities of crystals make them key materials in technological fields ranging from electronics and communications to energy, medicine and defence. For all these areas it is essential to dispose of crystals with the right properties, size and quality. Crystal growth has therefore become a major technological challenge.



Different biological crystals «grown» for research into their structure. © IUCr journals

## Crystallogenesis

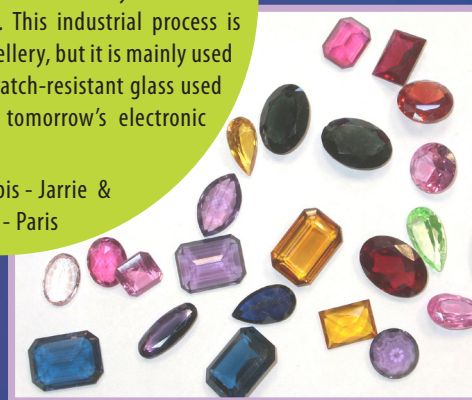
The point of crystallogenesis is simple: to form a solid object with atoms organised in a periodic array. This organisation is spontaneous but **time must be allowed for the process** and the period varies with the compound in question.



Sapphires, rubies and corundum ...

The crystals of corundum, sapphire or ruby are «grown» (crystallized) at very high temperatures by dropping alumina powder in a flame; this industrial process was discovered by Verneuil in 1902. These man-made crystals are as perfect as those in nature. This industrial process is used to make low-cost jewellery, but it is mainly used in Europe to make the scratch-resistant glass used for luxury watches or tomorrow's electronic circuit boards.

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## Take your time to make large crystals

When a molten compound is suddenly cooled (tempered) its atoms «freeze», without regaining the long-range order they displayed before heating (amorphous glass). If cooling is sufficiently “slow” however, the atoms and molecules have time to move and optimise their interactions and compactness. It is these two factors which generate the atomic order which is regularly repeated, and which will be propagated to new molecules/atoms joining those already solidified. Every atomic “layer” reproduces the order of the layer below and acts as a model or “pattern” for those above. The period of time may vary considerably according to each material. If you want to choose between a stack of small crystals or a few large crystals, you’ll need more time!



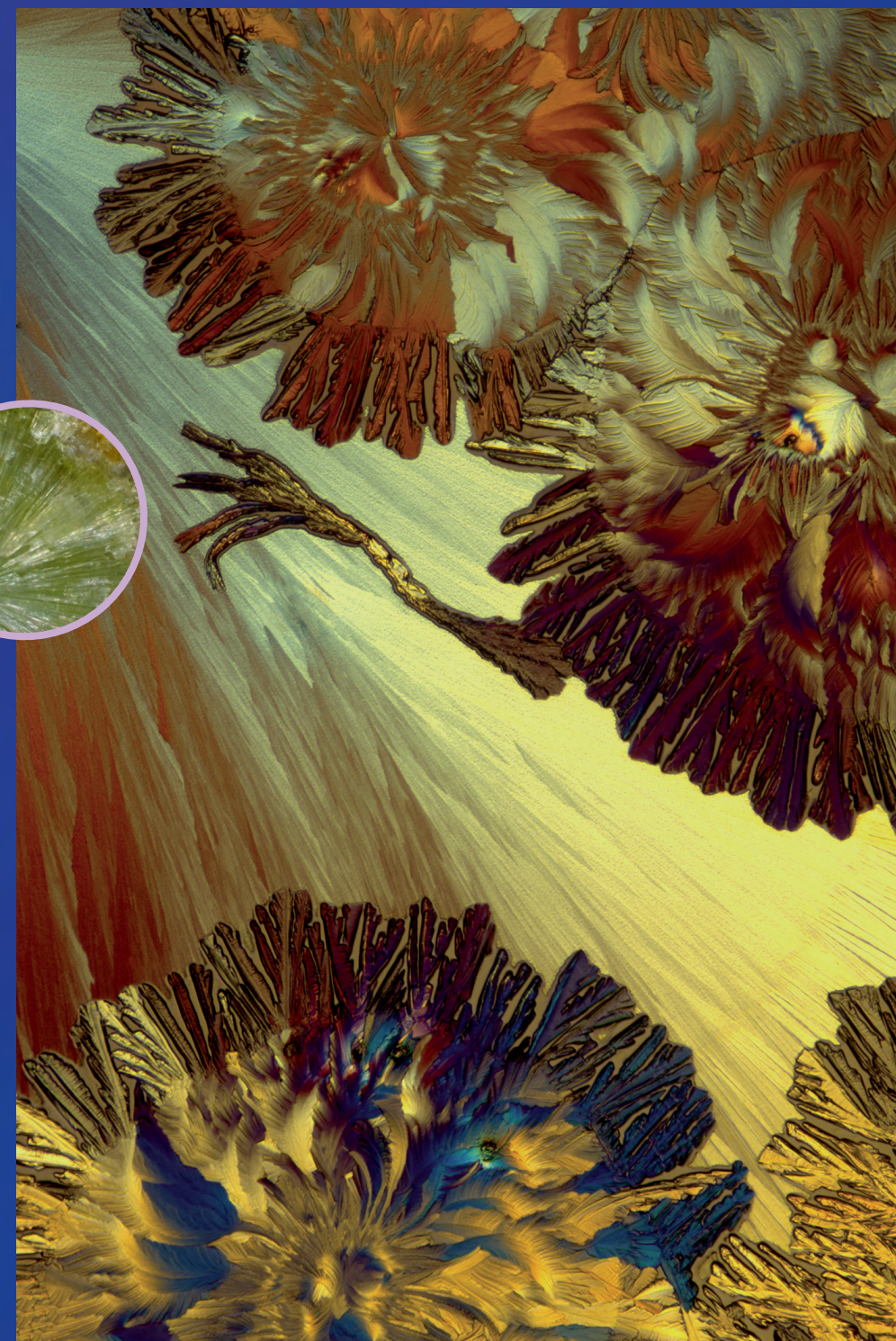
Artificial crystal production

The process of growing a crystal usually starts by bringing the compound to be crystallized to a non-solid state, either gaseous or liquid (molten or dissolved in a solvent). The compound is then slowly returned to a solid state under controlled conditions, thus ensuring the appropriate order is established. This protocol allows not only industrial quartz crystals to be produced but also multi-coloured crystals for use in educational workshops.

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Motifs of Wavellite crystal. Source : Artisa



Recrystallisation of citric acid, Jeanne Michaud IMPMC - Paris , © CNRS-Images

Crystal, an object in application

